NAM NGIEP 1 POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

February 2020

					
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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BBS	Biodiversity Baseline Survey
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL,
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
CTA	Common Terms Agreement
DEB	Department of Energy Business, MEM
DEPP	Department of Energy Policy and Planning, MEM
DEQP	Department of Environment and Quality Promotion, MONRE
DESIA	Department of Environmental and Social Impact Assessment, MONRE
DFRM	Department of Forest Resources Management, MONRE
DLA	Department of Land Administration, MONRE
DSRP	Dam Safety Review Panel
EC	Electrolytic Conductivity
ECOCD	EGAT Construction Obligation Commencement Date
EDL	Electricite du Laos
EDL PPA	Power Purchase Agreement between NNP1PC and EDL
EGAT	Electricity Generating Authority of Thailand
EGATi	EGAT International Company Limited
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund

ERIC	Environmental Research Institute Chulalongkhorn University
ERM	Environmental Resource Management
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
FY	Fiscal Year
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HH	Household
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
km	kilometre
kV	kilo-Volt
LEPTS	Lao Electric Power Technical Standard
LHSE	Lao Holding State Enterprise
LTA	Lender's Technical Advisor
M	million
m	metre
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR
MOF	Ministry of Finance, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NCI	Non-Compliance Issue
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NPF	National Protection Forest
NTFP	Non-Timber Forest Products

NT2	Nam Theun 2 Hydropower Project
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
PAFO	Provincial Department of Agriculture and Forestry
PAP	Project Affected People
PD	Property Damage
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PvPA	Provincial Protection Area
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SLBMP	Salvage Logging Biomass Management Plan
SOP	Standard Operating Procedure
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division of NNP1PC
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UXO	Unexploded Ordinance
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Waste Water Treatment System

EXECUTIVE SUMMARY

In February 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received three Site Specific Environmental and Social Management Plans (SS-ESMMP) and three Site Decommissioning and Rehabilitation Plans for review and approval.

The monthly site visit by the Bolikhan District EMU (Bolikhamxay Province) and a quarterly mission of EMU Xaysomboun Province were not carried out in February 2020.

The effluent monitoring results for the camps in February 2020 indicate that all the camps complied with the standards for total coliform and faecal coliform, except at the Main Powerhouse (EF19). However, the results of ammonia nitrogen and total nitrogen continue to fluctuate over the month and comply with the relevant effluent standards for some camps. The effluent from Owner's Site Office and Village (EF01) fully complied with the standards. NNP1PC is in the process of negotiating with the shortlisted external consultant to assess and evaluate the design and operation of the existing WWTS at the ESD camps (former IHI and HM Hydro Camps) and to provide an improved design using a more permanent technology.

The Dissolved Oxygen (DO) levels at the surface of the Main Reservoir (R1, R2, R3, R4 and R5) were generally between 2 mg/L and 9 mg/L. In the Re-regulation Reservoir (R6 and R7), the DO was generally below 5 mg/L during the period.

The discharge from the re-regulation dam alternated between discharges from the gate and turbine. Similar to January 2020, all DO concentrations (except one sample at NNG08 on 05 February 2020) were below 6 mg/L at Nam Ngiep downstream stations and not in compliance with the National Standard. However, no dead fish were observed in Nam Ngiep downstream during the periods with low DO. NNP1PC is in the process of hiring an international consulting company to assist with the design of additional aeration systems to improve the DO level downstream. In addition, NNP1PC is testing a combined discharge of water from the gate and turbine to observe the water quality downstream taking into account the lag times.

A total of 36.6 m3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 26.1 m3 compared to January 2019 due to the full operation of OSOV and staff accommodation at the new ESD camp. A total of 2,680 kg of recyclable waste was recorded at the Community Waste Bank. A total of 30.6 m3 of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at the Houay Soup Landfill. A new local Contractor for waste collection and operation of NNP1PC landfill and Houy Soup landfill was on board since 24 February 2020.

NNP1PC is processing the procurement of office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces in implementing the activities of AIP2019. NNP1 also signed a contract with a shortlisted boat supplier for the supply of three aluminium boats that will be handed over to Bolikhamxay and Xasomboun Provincial WRPOs for reservoir patrolling. Bolikhamxay and Xaysomboun Provincial WRPOs are implementing the AIP2019.

Biodiversity offset related activities under the components of spatial planning and regulation as well as law enforcement continued in February 2020 whilst other activities will be resumed after the approval of NC-NX AIP2020 by ADB and fund is transferred to GOL. The draft of AIP2020 is being reviewed by ADB and further discussed with IAP Biodiversity expert and BSP (WCS) during

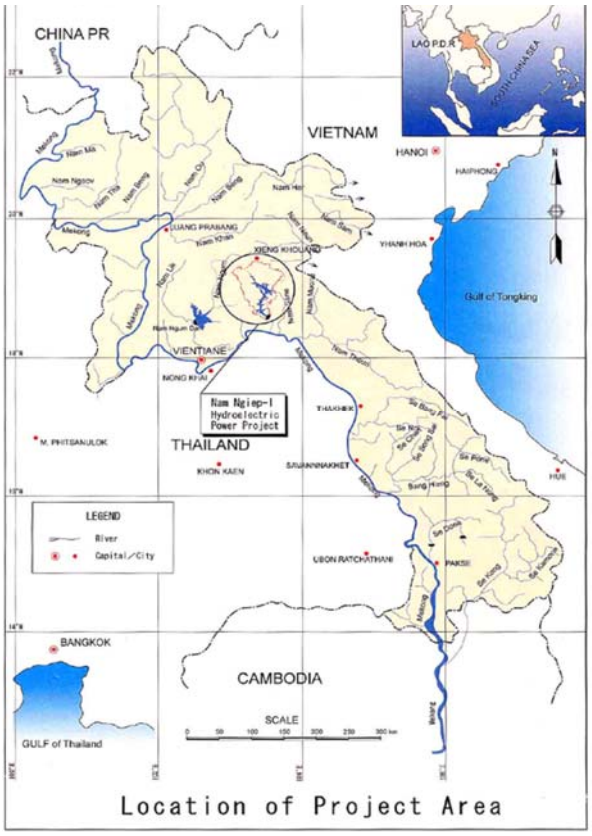
the IAP Biodiversity and LTA Environment mission which was undertaken during 23-28 February 2020.

The fish catch monitoring for January 2020 in Nam Ngiep watershed was dominated by Channa striata, Tor sinensis, Oreochromis niloticus, and species groups of Poropuntius and Hampala that are classified as Least Concern (LC) according to the IUCN Red List, except Tor sinensis which is classified as Vulnerable (VU).

1. INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhan District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province (Fig. 1-1).

FIGURE 1-1: LOCATION MAP



The project will consist of two dams. The main dam which is located 9.0 km upstream of Hat Gnuin Village in Bolikhan District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At almost 150 m high, the main dam will be the second largest in Lao PDR. The Power Station at this dam will generate up to 272 MW of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines will be required to transport the electricity generated by the project. From the main power station, a 230-kV line will run for 125 km to the Nabong outside Vientiane Capital. A 115-kV transmission line will be constructed by EDL from the Re-regulation Power Station to Pakxan substation over a distance of 40 km.

This Environmental Monthly Monitoring Report (EMMR) provides a summary of environmental monitoring activities and mitigation actions in January 2017. The EMMR was prepared by the Project's Environmental Management Office (EMO). It has been internally reviewed and cleared by EMO senior technical staff and management prior to submitting the report to the Government of Lao PDR (GoL) related agencies.

The EMMR and other related reports including related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are publicly disclosed on the Project website in line with the ADB and GoL Public Disclosure Policies. Hard copies of the final reports will also be available upon requests at the Project's main office in Vientiane Capital and field office in Pakxan, Bolikhamxay Province.

2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction works for the Project have been carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-Mechanical Works and the 230 kV Transmission Line Works. Each Contract is in its Defects Notification Period all ending variously in 2020 or 2021 following the issue of Taking-over Certificates in 2018 and 2019.

Figure 2-1 shows the progress of the minor outstanding work and defects that comprise the Punch List of work items completed for each of these four principal Contracts for the Project. An addendum to the Punch List is maintained for each Contract for any and all defects list that are discovered during the Defects Notification Period with relevant tabular records made of the date of the discovery, the nature of the defects and by what date the defect was remedied.

FIGURE 2-1: SUMMARY PROGRESS OF MINOR OUTSTANDING WORK AND DEFECTS AT 7 FEBRUARY 2020

Type of Contract Works		Total Items	Items Completed	Completion by No. of Items	Total Value of Items	Value Completed	Completion by Value	Taking-Over
		(No.)	(No,)	(%)	(USD)	(USD)	(%)	(Date)
Civil	RR Power Station	74	74	100	108,890	108,890	100	31-Jan-19
	Main Power Station	482	480	99	5,507,375	5,307,375	96	31-Jan-19
Electro-Mechanical	RRPS	170	170	100	6,515	6,515	100	16-Mar-19
	MPS	95	95	100	10,950	10,950	100	27-Aug-19
Hydro-Mechanical	RRPS	39	39	100	8,825	8,825	100	16-Mar-19
	MPS	174	174	100	13,775	13,775	100	31-Mar-19
230 kV Transmission Line		301	301	100	150,000	150,000	100	31-Jul-18

2.1 CIVIL WORK

The Civil Works Contract was executed between Obayashi Corporation and the Nam Ngiep 1 Power Company on 30 September 2013 and the Notice to Proceed was issued on 03 October 2014. Excavation works of the main dam, the diversion tunnel and the re-regulation dam were commenced in October 2014 and completed in February 2016, following which the concreting works were commenced.

The cumulative actual work progress of the Civil Works until the end of March 2019 was 100 % (compared to planned progress of 100 %) calculated as the value of achieved Interim Milestone Payments excluding advance payment.

The Civil Works overall was always on or ahead of schedule despite increased quantities of dam excavation and slope stabilisation and additional RCC placed in the shear key. During the initial dam excavation and since, it has been written in each Monthly Report, *'the complex bedding of hard over soft layers of rock and the folding nature of these layers in the foundation rock of the main dam below the old river bed had created difficulty to finalise the foundation design to the satisfaction of the Dam Safety Review Panel in all respects'*.

Accordingly, further review of the dam foundation design was carried out to create sufficient safety factor for stability against sliding of the dam on the weak zones. This resulted in further excavation and concreting of a shear key structure in the old river bed, taking the dam height to 167 m, measured from the deepest excavation level to the crest level, some 19 m higher than anticipated. The original schedule is maintained as a result of the combined efforts of the Owner, the Owner's Engineer and all the principal Contractors and their Subcontractors.

The additional excavation works were completed at the end of February 2016 and RCC consolidation grouting and RCC placement for the main dam were commenced on 10 May and 19 April 2016 respectively. The concrete level at the main dam reached El. 321.9 m at the left bank on 29 April 2018 and at the right bank at the end of March 2018. The placed volume of RCC was achieved in close to the planned schedule despite the losses of time resulting from the additional excavation and concreting in the foundation, the loss of fly-ash supply in December 2016, and the fatal accident.

Since the impounding of the Main Dam started on 15 May 2018, monitoring has been carried out to confirm the dam stability, especially to the right abutment where some anomalous results had been noted. Dam monitoring results are shown in a separate 'Monthly Report on Main Dam Instrumentation and Monitoring'. Many of the original concerns have been explained or are better understood. The unforeseen consequences which are considered likely to have been caused by the closing of bedding plane openings, as one of the possible causes considered, began unfolding with events in August 2018 when loading of the dam toe appeared to have caused an inclination of the main powerhouse to upstream and towards the old river bed such that the setting and fixing vertically of both turbine generating units within the required tolerances was not possible. This movement of the powerhouse also affected associated structures such as the penstocks and the intake valve. After the occurrence of this inclination issue, it has been found that artesian aquifer, which was not pressurized before initial impounding, exists under the main powerhouse foundation. Drainage to relieve the pressure is an important means of controlling the artesian aquifer. All current information and opinion are contained in the separate 'Root Cause Assessment of the Main Powerhouse Inclination' which was endorsed by academic authorities. This Report was sent to the insurance company in support of the insurance claim on this issue.

Monitoring of the instruments initially installed continues, more instruments were installed, further drainage drilling was carried out. As related above, all current information and opinion is contained in the separate September Monthly Report on Main Dam Instrumentation and Monitoring. This Report was sent to the Dam Safety Review Panel for review and comment. The reservoir water level of the main reservoir finally reached Full Supply Level of El. 320 m on 17 August 2019 whilst achieving dam safety. At the 19th DSRP Meeting which was held in October 2019, DSRP included in their Report a 'Dam Safety Endorsement' stating that the main dam, re-regulation dam and dyke are safe and fit for purpose, subject to a continued programme of appropriate monitoring, safe project operation and satisfactory resolution of the outstanding issues.

The leakage through drainage pipes from the Bottom Conduit Gate decreased from around 30 m3/min in June 2019 to 1 m3/min in September 2019 thanks to additional grouting using holes drilled from the main dam foundation gallery, a manageable amount, and the permanent concrete plug in this Conduit had been placed since 08 November 2018 after obtaining agreement of the DSRP and completed in 21 January 2019. NNP1PC will study various options to ensure that the reservoir water pressure is safely confined in the long term based on the recommendations of the DSRP.

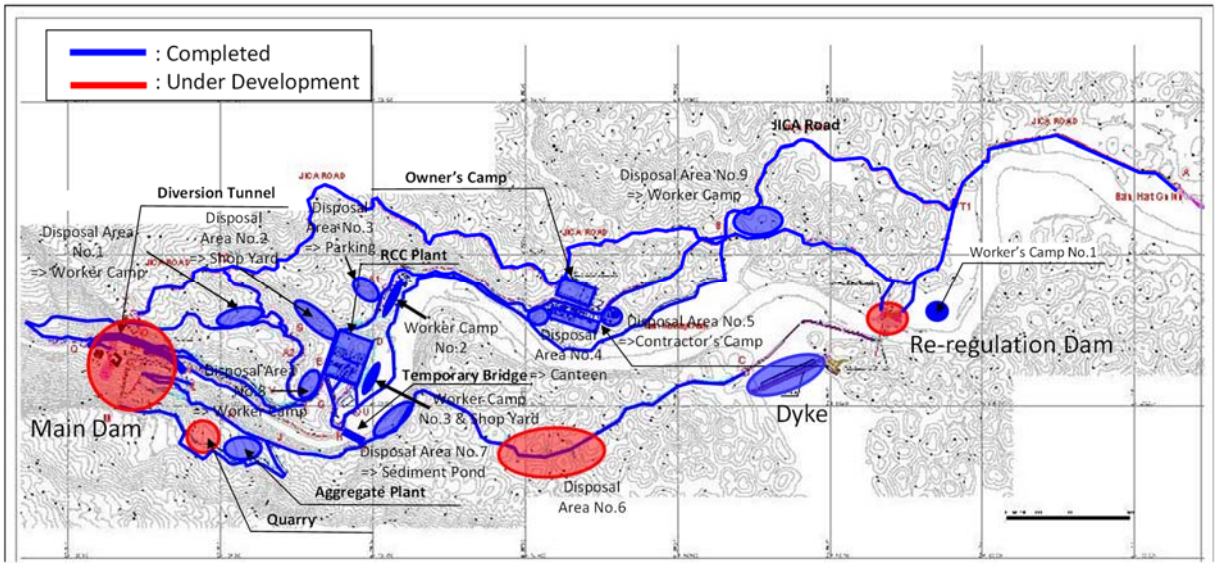
The repairs to the foundation of leg 4 of 230 kV TL Tower No.1 were completed in February 2019. The remaining excavation of the plunge pool was finished in January 2019. The reinforced concrete parapet wall was completed in December 2018 and road deck to the main dam crest and the concrete spillway chutes and piers completed in January 2019.

The issue of a Taking-over Certificate for the Civil Works for both the Re-regulation Power Station and the Main Dam and Main Powerhouse dated 31 January 2019 was made on 19 August 2019 and 22 October 2019, respectively.

2.1.1 ACCESS ROAD CONSTRUCTION

All main access road construction works were completed following an early December 2013 start, and maintenance of these will continue until the anticipated commissioning date in August 2019, six months after when the Civil Contract Time for Completion is reached. Temporary access roads are constructed to reach the various construction activities and others will be developed or modified as is necessary as activities change to reach current or new areas of dam concreting and consolidation grouting, the upstream and downstream cofferdams and the main powerhouse and belt conveyor support tower foundations. The layout of the access road system is as shown in ***Figure 2-2*** below. The Civil Contractor is responsible for decommissioning and rehabilitating the temporary roads as they become redundant.

Figure 2-2: Plan of Site Access Roads with Major Work Area and Temporary Facilities



2.1.2 MAIN DAM AND POWER HOUSE

After starting the main dam excavation in October 2014 on the left bank, these works were about one month advanced when diversion of the Nam Ngiep River was achieved at the end of October 2015. However, excavated volumes were 20 % greater in total than expected and part of this additional work was necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following significant efforts on Site, the additional excavation work was completed at the end of February 2016. The cost of the additional excavation and RCC concrete placement necessitated expenditure of contingency amounts provided exactly for such eventualities. The dental concreting works were commenced in March 2016, and conventional levelling concrete placement for the main dam in the 'shear key' structure up to El. 170.5 m was completed in the middle of April 2016. Consolidation grouting at the main dam area was commenced on 10 May 2016 and RCC concrete placement for the main dam body was commenced on 19 April 2016. Consolidation grouting covers the whole footprint of the main dam and RCC concrete placement and

consolidation grouting are implemented in parallel, section by section. The progress of RCC concrete placement is 100 % complete. The dam height has reached crest level at El. 321.9 m at both left bank and right bank. The plunge pool excavation was started after main dam impounding and this work has been suspended because of spilling water from spillway gate during rainy season in 2018. It has resumed from the end of October when the amount of inflow has decreased to around 100 m3/s and around 121,000 m3 or 100 % of total excavation has now been completed.

The diversion conduit gate of the main dam body has some leakage of water initially and the casting of the temporary concrete plug behind it was completed in the conduit in June 2018. The permanent concrete plug had been placed since 08 November 2018 after DSRP permission was granted.

Main powerhouse sub-structure excavation works were completed in January 2016 and levelling concrete works were started in coordination with installation of the grounding system and the penstock concrete encasement. Major concrete of the main powerhouse was substantially completed in December 2017. The powerhouse concreting works has been completed in January 2019.

2.1.3 RE-REGULATION DAM, POWERHOUSE AND DYKE

The re-regulation powerhouse excavation and cofferdam works for the first river diversion were commenced in early October 2014. The excavation works for the powerhouse on the left bank were fully completed down to El. 146.7 m at the end of February 2015.

Structural concrete works were commenced in March 2015, in coordination with installation of the grounding system. The progress of overall re-regulating dam and powerhouse works at the left bank section and the right bank and labyrinth weir are shown in ***Figure*** below. After the completion of the re-regulation dam above, impounding of the reservoir has been carried out having been commenced on 15 May and been completed on 24 May 2017. After Main Dam impounding started, the reservoir storage of the re-regulation dam has been used for the riparian discharge to downstream in accordance with the Concession Agreement.

FIGURE 2-3: COMPLETED RE-REGULATION DAM AND POWERHOUSE AT THE END OF JUNE 2018

2.1.4 TEMPORARY WORK FACILITY

2.1.4.1 DIVERSION TUNNEL INLET AND OUTLET

The diversion tunnel, excavated over 600 m in length and 10 m in diameter, was commenced in October 2014 by drill and blast techniques and completed in late September 2015. The river diversion took place on 31 October 2015 after completion of inlet and outlet structures together with construction of earth-fill cofferdams upstream and downstream.

The second diversion to divert the river from the diversion tunnel through the bottom outlet or conduit in the dam was implemented on 13 January 2018. Dewatering of the diversion tunnel and construction of the concrete plug was commenced during January 2018. Concrete works and the valve installation for discharge was completed before the start of main dam impounding. On 22 May 2018, the valve discharge commenced by using 3 valves with around 5 m^3/s discharge in total. Construction of concrete plug including valve was completed on 27 January 2019.

2.1.4.2 SECONDARY UPSTREAM COFFERDAM

The concrete placement works in both conventional and roller-compacted concrete (CVC and RCC respectively) for the secondary upstream cofferdam were started in November 2015 and completed ahead of construction schedule in the middle of February 2016. The grout curtain works for this cofferdam were completed on 02 April 2016.

2.1.4.3 PLANT YARDS

These comprise the Aggregate Crushing Plant, the CVC Batching Plant and the RCC Batching Plant.

Foundation work and installation of equipment were completed at all the plant yards and the belt conveyor system from the RCC plant to the main dam was completed in early April 2016. Decommissioning and rehabilitation is underway on all plants and is almost completed for the Quarry and the Aggregate Crushing Plant.

Demobilization of plant facilities for both RCC and CVC plants was completed in December 2019. The vegetation improvement for rehabilitation of those areas is ongoing

RCC plant yard_ Vegetation improvement ongoing

CVC plant yard_ Vegetation improvement ongoing

2.1.4.4 QUARRY

After removal of overburden the excavation of raw materials for aggregate crushing were started in July 2015. The nature and type of the rock being exploited was acceptable though unsuitable soil layers were removed to spoil disposal areas, and good quarry management prevailed. It was considered that the quarry as originally conceived would not yield enough rock material of the required specification to complete all RCC and CVC concrete works for the Project. Permission was taken to extend the existing quarry within the boundaries already approved after a preliminary soil investigation confirmed that appropriate material could be exploited as below. The planned extension area of the quarry received approval from local government. (See ***Figure 2-4*** below)

The surface clearing, topsoil and overburden removal works at the extension area were completed in December 2016 and its development works was commenced in January 2017. The final blasting was carried out 27 March 2018. GOL have acknowledged that the quarry operation is complete. After several inspections by GOL and ADB for the Lenders, the quarry site has been improved by such as partial levelling, vegetation at the berms of slopes and large rock installation at top of slopes from an environmental and a safety point of view. Furthermore, a fence around the pond, which is created at the quarry only during the rainy season and is dry during dry season, will be installed to prevent people and animals from entering the pond, subject to ADB approval. A gate near the steel bridge also a barrier to public access. Permanent fence installation around pond as shown in the below picture will not be installed and fence for road safety will be installed at the top of the right bank upper quarry roadside. The levelling of quarry bottom will be implemented from January 2020.

Figure 2-4: Quarry Area View

2.1.4.5 DISPOSAL AREAS

The disposal areas are on the right bank has been available for operation since January 2015, as was the adjacent waste Disposal Area No.9. Disposal Area No.9 along Road P1 near the start of Road T5 started operation in April 2015. Unsuitable material from the quarry has ceased to be hauled to Disposal Area No.6 and Disposal Area No.9 has been developed by the Electrical and Mechanical Works Contractor as stated above.

2.2 ELECTRICAL AND MECHANICAL WORKS

The EMW Contract was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the Notice to Proceed was issued in 03 October 2014. The cumulative

work progress of the Electrical and Mechanical Works by value at the end of November 2019 was 100 % (compared to planned progress of 100 %).

The main activities carried out during this month are described below:

Figure 4.2-1: Removing of servo amplifier and modifying wiring circuit

Figure 4.2-2: Uploading the new logic to the governor system

2.3 HYDRO-MECHANICAL WORKS

The HMW Contract was executed between IHI Infrastructure Systems (IIS) and NNP1PC on 18 April 2014 and the NTP was issued to the Contractor on 03 October 2014. The actual cumulative work progress of the Hydro-Mechanical Works until the end of March 2019 was 100 % (compared to planned progress of 100 %). NNP1PC issued the Taking Over Certification for the main powerhouse and the re-regulation powerhouse, which was dated on 31 March 2019 for the main powerhouse and 16 March 2019 for the re-regulation powerhouse, to IIS on 30 September 2019 and 16 August 2019, respectively.

2.4 230 KV TRANSMISSION LINE WORKS

The 230 kV Transmission Line Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Works Contractor on 03 October 2014. The cumulative actual work progress of the Transmission Line Works at the end of July 2018 was 100 %, the same as planned progress. NNP1PC issued the Taking Over Certification, which was dated on 31 July 2018, to Loxley on 6 November 2018. The Defects Notification Period for this Contract expired on 31 July 2019.

3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 COMPLIANCE MANAGEMENT

In February 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental and Social Management Plans (SS-ESMMP) for review and approval.

TABLE 3-1: SS-ESMMP AND DOCUMENTS REVIEW STATUS IN FEBRUARY 2020

Title	Date Received	Status
DWP & SS-ESMMP for Installation of Double Corrosion Protection Rock Bolts at the Left Bank Slope	07 February 2020 (2nd submission)	Under review
DWP & SS-ESMMP for Supply and Installation of Log Booms at the Main Dam and Re-Regulation Dam	12 February 2020 (1st submission)	Under review

The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC to the Contractors is summarized in below

TABLE 3-2: SUMMARY OF ONCS AND NCRS

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from January 2020	1	0	0	0
Newly Opened in February 2020	4	0	0	0
Total in February 2020	**7**	**0**	**0**	**0**
Resolved in February 2020	1	0	0	0
Carried over to March 2020	4	0	0	0
Unsolved Exceeding Deadlines	**2**	**0**	**0**	**0**

3.1.1 INSPECTION BY ENVIRONMENT MANAGEMENT UNIT

The monthly site visit by the Bolikhan District EMU (Bolikhamxay Province) and a quarterly mission of EMU Xaysomboun Province were not carried out in February 2020.

3.2 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), faecal coliforms, E.Coli bacteria and total coliforms have been carried out by NNP1PC's environmental laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) monthly and quarterly to the ADB. The reports are also published on the Company's website at https://namngiep1.com/resources/monitoring-reports/

3.2.1 EFFLUENT DISCHARGE FROM CAMPS AND CONSTRUCTION SITES

Detailed monitoring results are provided in the ***Annex B*** of this Report. The effluent monitoring results for the camps in February 2020 indicate that all the camps complied with the standards for total coliform and faecal coliform, except at the Main Powerhouse (EF19).

However, the results of ammonia nitrogen and total nitrogen continue to fluctuate over the month and comply with the relevant effluent standards for some camps. The effluent from Owner's Site Office and Village (EF01) fully complied with the standards.

The status of the implementation of the corrective actions addressing non-compliances at the camps and key construction sites that continue to have non-compliances is summarized in below.

TABLE 3-3: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT CAMPS AND CONSTRUCTION SITES

Site	Sampling ID	Status	Corrective Actions
Owner's Site Office and Village (OSOV)	EF01	Fully compliance.	
ESD Camp (HM Hydro Main Camp)	EF13	Non-compliance for total nitrogen and ammonia-nitrogen.	An external expert's contract is being negotiated to evaluate the design and operation of the existing WWTS and to provide an improved design using a more permanent technology.
ESD Camp (former IHI Main Camp)	EF14	Non-compliance for total nitrogen and ammonia nitrogen.	As above.
Main Powerhouse	EF19	Non-compliance for COD and total coliform (first fortnightly sampling), TSS, total nitrogen and ammonia nitrogen.	As above.
Spoil Disposal Area No.2	DS04	Non-compliance for pH on 21 and 27 February 2020.	The low pH has been a natural characteristic of the water which flows through this area during the dry season since the start of the Project.
Upstream Spoil Disposal Area No.2	DS04-US	Fully compliance.	

3.2.2 AMBIENT SURFACE WATER QUALITY MONITORING

The ambient surface water quality monitoring programme comprises five monitoring stations in the main reservoir (R1-R5), two stations in the re-regulation reservoir (R6 and R7), five stations in the mainstream Nam Ngiep (NNG01 and NNG05 to NNG08) and four stations in the

main tributaries to Nam Ngiep (Nam Chiane [NCH01], Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).

In addition, weekly depth profile monitoring (pH, DO, conductivity, TDS and temperature) has been undertaken since 18 September 2018 for stations located in the re-regulation and main reservoirs. The water quality programme is summarized in ***Table 3-4*** and the location of the monitoring stations are shown in below.

TABLE 3-4: MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R1, R2, R3, R4, R5; - Nam Ngiep downstream: NNG05, NNG06, NNG07 and NNG08; Tributaries: Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01].
Fortnightly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU)	All stations
Monthly	TSS (mg/L), BOD_5 (mg/L), COD (mg/L), NH_3-N (mg/L), NO_3-N (mg/L), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml), Hydrogen sulphide (mg/L), Phytoplankton biomass, TOC and TKN.	As per ESMMP-OP

The monitoring results for key parameters (DO, TSS and BOD_5) during February 2020 are presented in ***Table 3-5, 3-6*** *and* ***3-7***. The full set of data for January 2020 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure 3-2.***

Main Reservoir

During February 2020, the water level in the main reservoir decreased from El. 309 m asl. to El. 306.4 m asl.

At R5, during 05-20 February 2020, the DO level in the upper 22.0 m was generally between 2 mg/L and 5 mg/L, and the entire water column below 32.0 m had a DO level of less than 1 mg/L. In addition, on 26 February 2020, the DO concentration in the upper 22.0 m was between 5 mg/L and 6 mg/L, and the entire water column below 26.0 m had a DO concentration of less than 1 mg/L.

At R4, the DO concentrations in the upper 5.0 m was generally between 4 mg/L and 6 mg/L, and in the entire water column below 24.0 m had a DO concentration of less than 1 mg/L.

The DO concentrations at R3 were recorded between 5 mg/L and 6 mg/L in the upper 3.0 m. The concentration of DO in the water column below 15.0 m was generally less than 1 mg/L, however, with a spike at 32 m depth of 1.72 mg/L on 04 February 2020.

The DO concentrations at R2 generally fluctuated between 0.07 mg/L and 5.82 mg/L in the entire water column.

At R1, the DO level was generally between 6 mg/L and 9 mg/L in the entire water column.

The measurements indicate the formation of oxyclines in R2, R3, R4 and R5.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean of 5 mg/L compared to high flow season means of about 100 mg/L – 250 mg/L and low flow season means of 20 mg/L - 50 mg/L.

The BOD5 measurements in the epilimnion were within the standard except at R1 with a concentration of 3.1 mg/L. The measurements in the hypolimnion at R4 and R5 showed BOD concentrations of 5.85 mg/L and 2.13 mg/L respectively.

Re-regulation Reservoir

In February 2020, the turbine discharge from the main dam varied between 22 m3/s and 124 m3/s interrupted by usually night-time periods with no discharge.

The DO measurements at R6 and R7 representing turbine discharges from the main dam generally had DO concentrations from about 1 mg/L to about 4 mg/L in the entire water column.

The BOD5 in R6 and R7 were below the limit of detection in February 2020.

Downstream

During February 2020, the discharge from the re-regulation dam alternated between discharges from the gate and turbine. All DO concentrations were less than 6 mg/L at the Nam Ngiep Downstream stations (except one sample at NNG08 on 05 February 2020) and thus non-compliant with the National Standard. No dead fish were observed in Nam Ngiep downstream during periods with low DO. NNP1PC is in the process of hiring an international consulting company to assist with the design of additional aeration system to improve the DO level downstream. In addition, it is testing a combined discharge of water from the gate and turbine to observe the water quality downstream taking into account the lag time.

The BOD5 in the downstream stations were below the limit of detection.

FIGURE 3-1: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

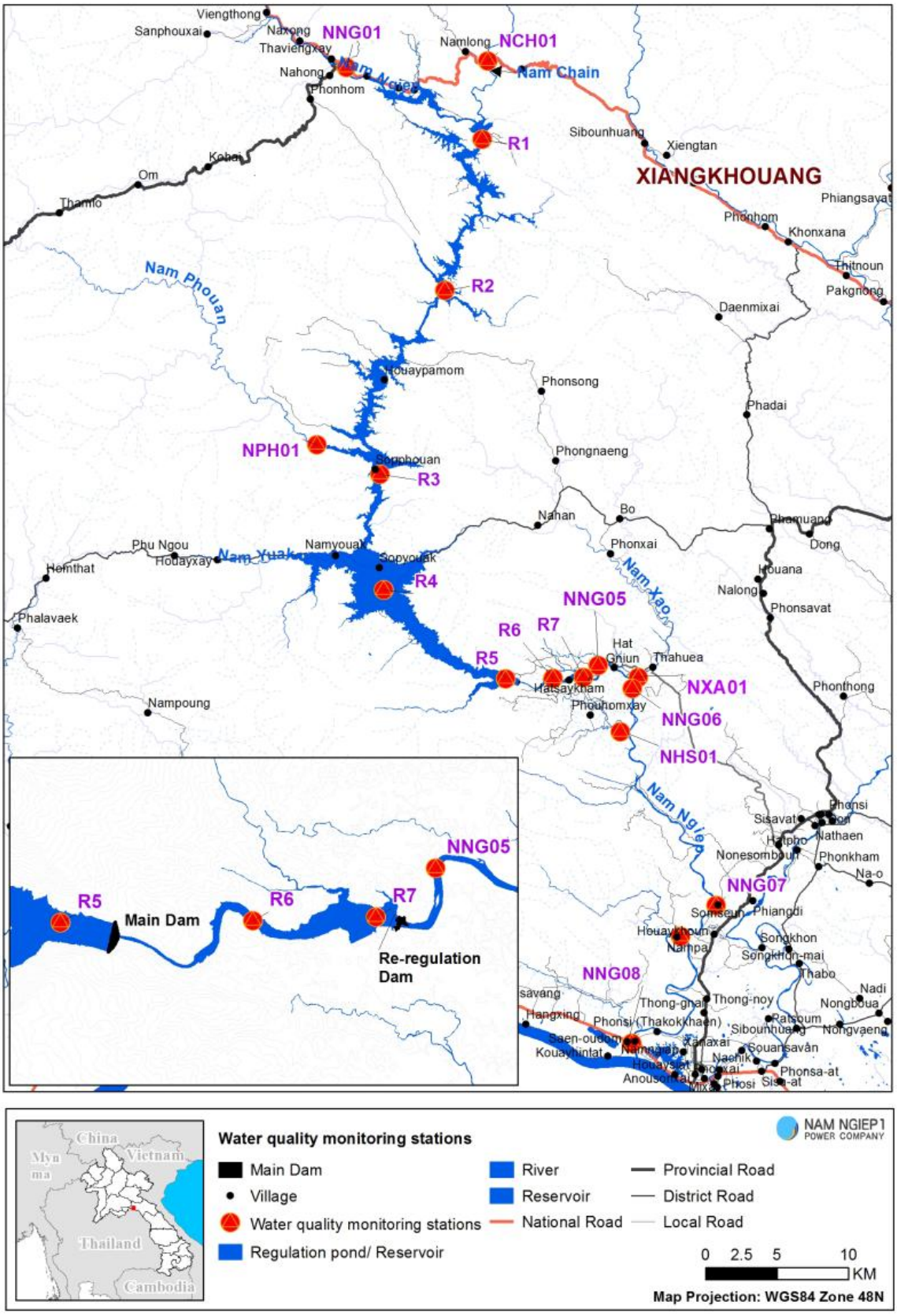


FIGURE 3-2: CONCENTRATION OF DISSOLVED OXYGEN IN THE UPPER 0.2 M SINCE THE START OF IMPOUNDING

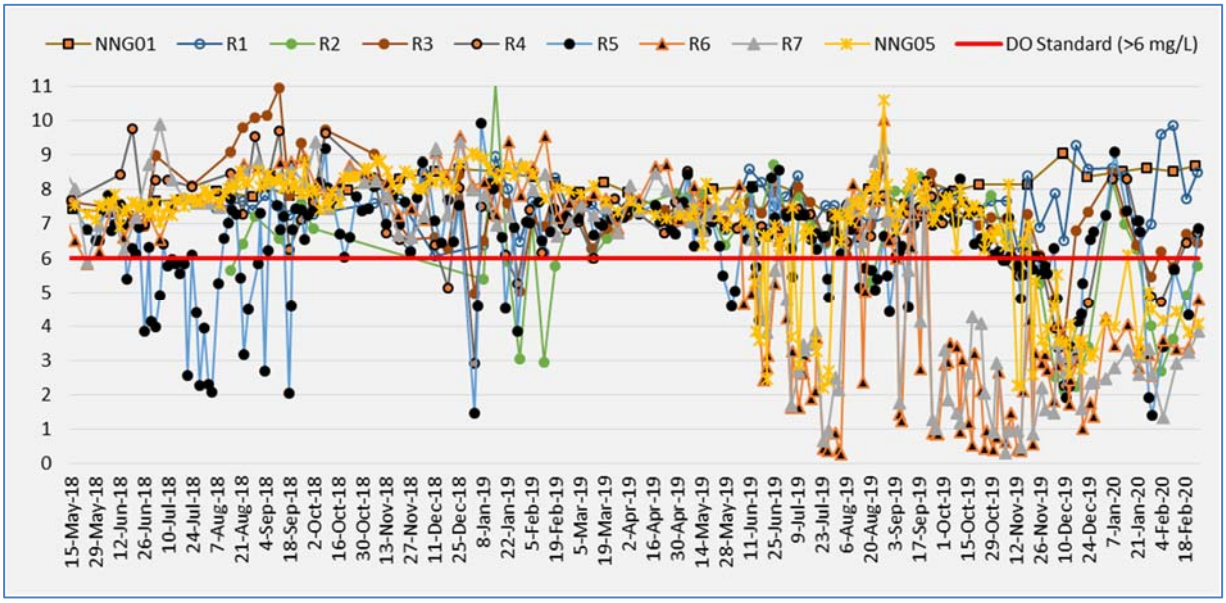


TABLE 3-5: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, WATER QUALITY STANDARD: >6.0 MG/L*

DO (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
4-Feb-20		9.6	2.7	6.18	4.72									7.99		
5-Feb-20						3.38	3.58	1.34	4.17	3.67	5.58	6.13			6.21	6.05
11-Feb-20	8.5	9.9	3.6	5.73									8.91	7.81		
12-Feb-20					5.63	5.68										
13-Feb-20							3.33	2.91	4.43	4.13	5.06	5.24			6.31	6.09
19-Feb-20		7.7	4.9	6.69	6.44									7.35		
20-Feb-20						4.34	3.35	3.22	3.8	3.88	5.49	5.64			7.03	6.67
24-Feb-20	8.7												8.47			
25-Feb-20		8.5	5.8	6.44	6.73									7.84		
26-Feb-20						6.86	4.77	3.84	4.08	4.09	5.22	5.63			6.06	6.23

TABLE 3-6: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR TOTAL SUSPENDED SOLIDS (MG/L) - WATER QUALITY STANDARD: NO STANDARD*

Total Suspended Solids (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
11-Feb-20	<5	15		<5									<5	11.62		
12-Feb-20					<5	<5										
13-Feb-20							<5	<5	<5	<5	11.4	11.3			5.6	<5

TABLE 3-7: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD_5 (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L*

BOD_5 (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
11-Feb-20	<1.0	3.1		<1.0									<1.0	<1.0		
12-Feb-20					<1.0	<1.0										
13-Feb-20							<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			1.87	2.12
11-Feb-20 Hypolimnion		<1.0														
12-Feb-20 Hypolimnion					5.85	2.13										

3.2.3 GROUNDWATER QUALITY MONITORING

During February 2020, community groundwater quality analyses were carried out for three wells located in Somseun Village, Nam Pa Village, Thong Noy Village and Pou Village.

Most results of community groundwater complied with the groundwater quality standards for water supply purposes, except some low content of faecal coliform and E.Coli bacteria as presented in below Table.

TABLE 3-8: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONG NOI AND POU VILLAGES

Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline				
pH	6.5 - 9.2	7.1	7.21	7.00	8.6
Sat. DO (%)			83	78.3	87.7
DO (mg/l)		6.56	6.45	5.94	6.83
Conductivity (µS/cm)		296	276	344	19.93
Temperature (°C)		28.4	27.1	28.5	26.2
Turbidity (NTU)	<20	0.68	0.71	0.82	1.17
Fecal coliform (MPN/100 mL)	0	0	4.5	4.5	0
E.coli Bacteria (MPN/100 mL)	0	0	4.5	2	0
Arsenic (mg/)	<0.05	0.001	0.0005	0.0018	0.001
Cadmium (mg/l)	<0.01	<0.003	<0.003	<0.003	<0.003
Total Iron (mg/l)	<1	0.02	<0.01	<0.01	0.021
Manganese (mg/l)	<0.5	<0.005	<0.005	<0.005	0.053
Mercury (mg/l)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002

3.2.4 GRAVITY FED WATER SUPPLY (GFWS) QUALITY MONITORING

During February 2020, water samples from water taps at Hat Gniun Village and Phouhomxay Village were analysed. The WPHX01 represents raw water in the head tank before the filtration system.

The results of the water quality analyses are presented in ***Table 3-9***. All parameters complied with the National Drinking Water Standards except for faecal coliforms and E. Coli at WTHH02, WHGN02, WPHX01 (intake), WPHX02 (tap water at the primary school in Phouhomxay Village) and WPHX03 (tap water at a house in Phouhomxay Village). The villagers generally use tap water for washing and cleaning. They were informed about the results and were encouraged to boil the water before drinking.

TABLE 3-9: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
07-Feb-20	pH	6.5 - 8.6	7.79	7.26	7.95	7.93	7.44
07-Feb-20	Sat. DO (%)		100.7	98.4	91.8	93.2	89
07-Feb-20	DO (mg/L)		7.96	7.73	7.44	7.43	7.13
07-Feb-20	Conductivity (µS/cm)	<1,000	84.9	173.1	20.04	14.33	28.5
07-Feb-20	Temperature (°C)	<35	26.3	26.7	24.8	25.8	25.5
07-Feb-20	Turbidity (NTU)	<10	0.81	1.7	0.8	0.82	0.96
07-Feb-20	Faecal Coliform (MPN/100 mL)	0	33	13	130	70	170
07-Feb-20	E.coli Bacteria (MPN/100 mL)	0	33	13	79	49	170
07-Feb-20	Arsenic (mg/L)	<0.05	<0.0003	<0.0003	N/A	N/A	<0.0003
07-Feb-20	Cadmium (mg/L)	<0.003	<0.002	<0.002	N/A	N/A	<0.002
07-Feb-20	Iron (mg/L)		0.062	0.039	N/A	N/A	0.161
07-Feb-20	Lead (mg/L)	<0.01	<0.01	<0.01	N/A	N/A	<0.01
07-Feb-20	Manganese (mg/L)	<0.5	0.01	<0.005	N/A	N/A	<0.005
07-Feb-20	Mercury (mg/L)	<0.001	<0.0002	<0.0002	N/A	N/A	<0.0002

3.2.5 LANDFILL LEACHATE MONITORING

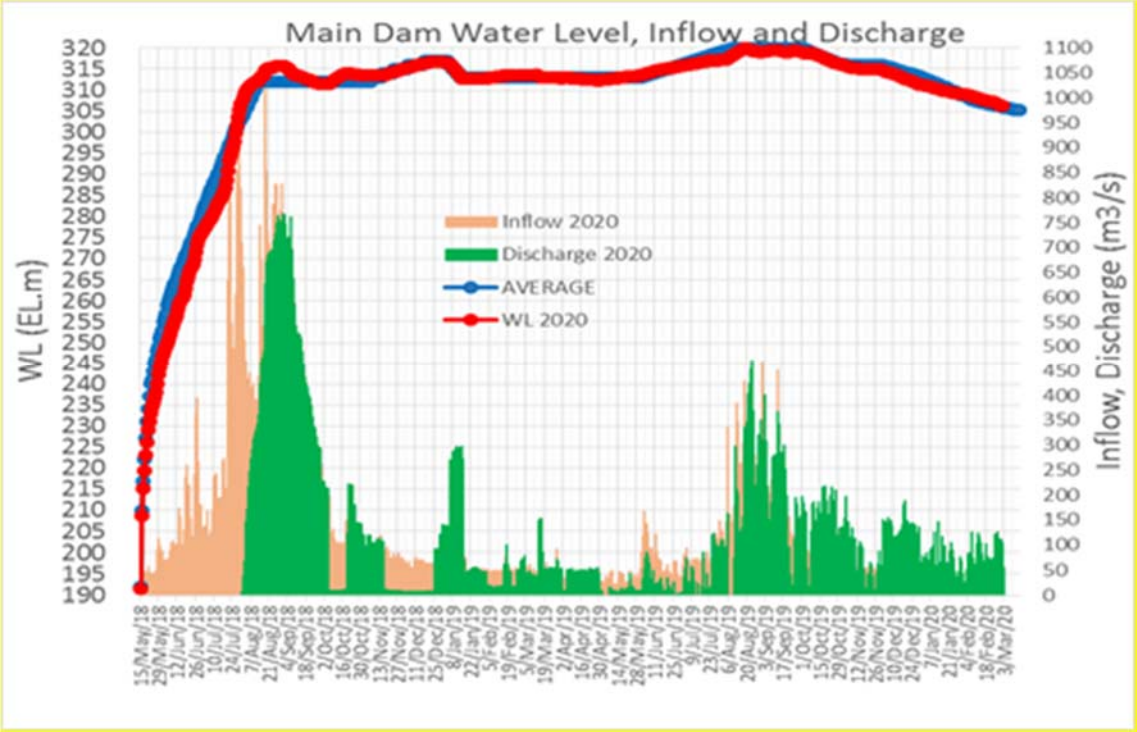
During February 2020, water sampling from NNP1 Project Landfill and at Houay Soup Solid Waste Landfill were not carried out because there was no inflow of leachate to the ponds and the last pond in both landfills had almost dried-up.

3.2.6 DISCHARGE MONITORING

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir since the start of the impounding on 15 May 2018 is presented in the graph in Figure 1-3.

During February 2020, the mean inflow to the main reservoir was 29 m3/s (min 17 m3/s and max 46 m3/s). During February 2020, the water level in the main reservoir decreased with 2.7 m from El. 309.1 m asl. to El. 306.4 m asl.

FIGURE 3-3: WATER LEVEL, INFLOW AND DISCHARGE FOR THE MAIN RESERVOIR

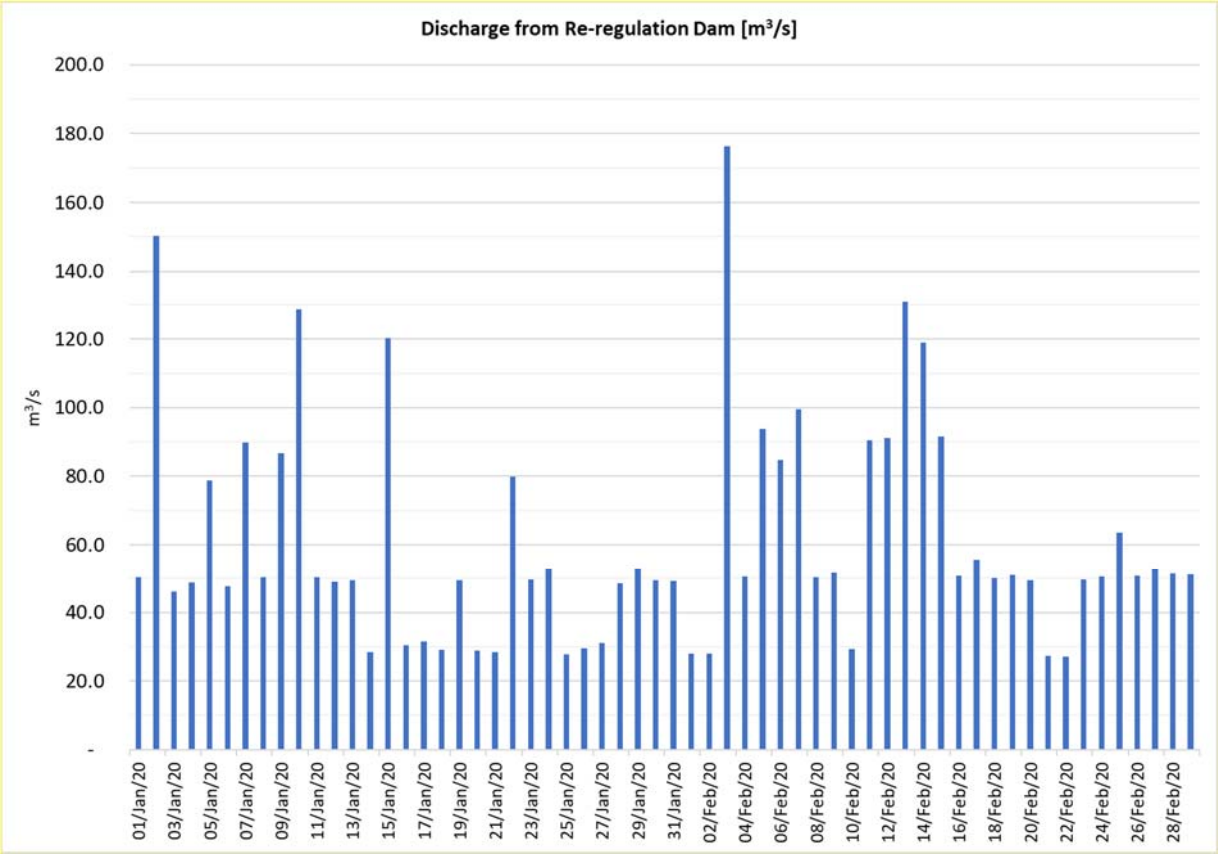


The discharge monitoring data for the re-regulation dam during January 2020 and February 2020 is presented in ***Figure 3-4***.

During February 2020, the mean discharge from the re-regulation dam was about 75 m^3/s interrupted by short periods – usually on Sundays - with gate discharge about 30 m^3/s. The discharge was kept above the minimum flow requirement of 27 m^3/s at all times.

The changes in the discharge from the re-regulation dam were informed in advance to the RMU and to the heads of the downstream villages, who then announced the changes to the communities over the village speaker systems.

FIGURE 3-4: DISCHARGE MONITORING AT THE RE-REGULATION DAM IN JANUARY 2020 AND FEBRUARY 2020



3.2.7 NAM NGIEP DOWNSTREAM WATER DEPTH MONITORING

In February 2020, EMO carried out four boat missions to monitor the water depth in the Nam Ngiep downstream of the re-regulation dam. A total of 19 sites have been identified with potential shallow water depths. None of these sites were difficult to navigate.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 SOLID WASTE MANAGEMENT

In February 2020, a total of 36.6 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 26.1 m^3 compared to January 2019 due to the full operation of OSOV and staff accommodation at a new ESD camp (former IHI/HM Hydro Camps). EMO conducted a waste management toolbox on NNP1 Project landfill operation, the project's waste management hierarchy as well as health and safety concerns to a new local waste collection Contractor. The Contractor received the Notice to Proceed (NTP) from NNP1PC and started working on the waste collection from the NNP1 Project site and villages on 02 March 2020.

TABLE 3-10: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by February 2020
Construction Activity				
1	Scrap metal	kg	0	0
Sub-Total 1		kg	**0**	**0**
Camp Operations				
2	Glass bottles	kg	0	18
3	Plastic bottles	kg	0	30
4	Paper/Cardboard	kg	0	17
5	Aluminium cans	kg	0	3
Sub-Total 2		**kg**	**0**	**68**
Grand Total 1+2		**kg**	**0**	**68**

The local villagers from Phouhomxay Village collected a total of 766 kg of food waste from the OSOV canteen for animal feed in February 2020, an increase of 136 kg compared to January 2020 as a result of more personnel at the new ESD camp.

TABLE 3-11: AMOUNTS OF FOOD WASTE COLLECTED BY VILLAGERS

No.	Site Name	Unit	Total
1	OSOV Canteen	kg	766
Total		**kg**	**766**

3.3.2 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

The types and amounts of hazardous material and hazardous waste stored on site in February 2020 are shown in below**Error! Reference source not found.**

TABLE 3-12: RESULTS OF HAZARDOUS MATERIAL INVENTORY

No.	Hazardous Waste Type	Unit	Total in February 2020 (A)	Used (B)	Remainder (A - B)
1	Diesel	Litre	12513	6386	6127
2	Gear Lubricant	Litre	6406	0	646
3	Chlorine Liquid	Litre	50	22	28
4	Grease	Drum (25 L)	29	0	29
5	Chlorine Powder	Kg	24	0	24
6	Sika	Can	7	0	7
7	Colour paint	Drum (20L)	3	0	3
8	Gasoline	Litre	0	0	0
9	Thinner	Drum (3 L)	1	0	1
10	Colour spray	Can	0	0	0

TABLE 3-13: RESULTS OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in February 2020 (A)	Dispose (B)	Remainder (A - B)
1	Used oil	Litre	2072	2000	72
2	Ink cartridge	Unit	119	0	119
3	Halogen/ fluorescent bulbs	Unit	78	0	78
4	Empty spray can	Can	80	0	80
5	Used tire	Unit	0	0	0
6	Used battery	Unit	0	0	0
7	Oil water mixture	Litre	0	0	0
8	Contaminated soil/ sand	Cubic Metre (m^3)	0.16	0	0.16
9	Clinic waste	kg	0.7	0	0.7

A new local waste collection Contractor has been on board since 24 February 2020 to undertake waste collection from the Project areas for disposal at NNP1 Project landfill as well as waste collection from the host and Phouhomxay Villages for disposal at Houay Soup Landfill.

3.4 COMMUNITY WASTE MANAGEMENT

3.4.1 COMMUNITY RECYCLING PROGRAMME

In February 2020, the Community Waste Bank received no recyclable waste from Phouhomxay Village and the two host villages. Some cardboards that were in bad condition was segregated and disposed of at Houy Soup landfill, making a new total of 2,680 kg of recyclable waste remaining in the Bank. A decrease of 71 kg compared to December 2019.

TABLE 3-14: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in January 2020	Additional in February 2020	Sold	Remaining in February 2020
Glass bottles	kg	1149	643	0	1,792
Paper/cardboard	kg	923.5	0	71	852.5
Plastic bottles	kg	35.5	0	0	35.5
Aluminium cans	kg	0	0	0	0
Scrap metal	kg	0	0	0	0
Total	**kg**	**2,108**	**77.5**	**77**	**2,680**

3.4.2 COMMUNITY SOLID WASTE MANAGEMENT

Approximately 30.62 m^3 of solid waste was collected from the host and Phouhomxay villages for disposal at Houy Soup landfill.

3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

3.5.1 WATERSHED MANAGEMENT

3.5.1.1 IMPLEMENTATION OF ANNUAL IMPLEMENTATION PLAN (AIP) 2019

NNP1PC processed the disbursement of USD 42,751 from NNP1PC additional No Net Loss (NNL) commitment which includes the procurement of office and field equipment totalling USD 19,494 to be processed by NNP1PC. NNP1PC also concluded a purchase contract with a boat supplier through a competitive bidding process at the end of February 2020. This supplier will provide three aluminium boats that will be handed over to GOL (Bolikhamxay and Xaysomboun Provincial WRPOs) for the NNP1 reservoir patrolling. The delivery of these boats is expected within 90 days.

Bolikhamxay Provincial WRPO continues with the preparation of Bolikhamxay Provincial Regulation for Watershed Management. A technical discussion on the first draft of the regulation was organized by Bolikhamxay Provincial WRPO on 19 February 2020. The meeting took note of the recommendations by NNP1PC-EMO team for further improvement. The WRPO team did not carry out any forest patrolling in February 2020. Xaysomboun Provincial WRPO is still preparing the proposal to commence the field verification of the Totally Protected Zones (TPZs) boundary in Anouvong and Hom Districts while waiting to receive the NNL fund transferred by NNP1PC to DOF's Project account.

NNP1PC-EMO together with a Consultant is finalising a Fishery Co-Management Plan. The improved draft was submitted by the Consultant on 13 February 2020 and further discussed with NNP1PC-EMO team on 24 February 2020. The re-submission is expected in the first week of March 2020 and the consultation with relevant GOL agencies will be scheduled afterwards.

NNP1PC-EMO together with a Consultant is conducting an assessment of options for sustainable livelihood opportunities focussing on nine watershed villages in Xaysomboun Province. The field assessment and data collection are re-scheduled to 04-13 March 2020.

3.5.2 BIODIVERSITY OFFSET MANAGEMENT

3.5.2.1 APPROVAL OF BIODIVERSITY SERVICE PROVIDER (BSP)

ADB and WCS have provided their feedback on the draft Memorandum of Understanding (MOU) to be signed between NNP1PC-ADB-WCS on 15 February 2020. The draft has been finalized by NNP1PC Lawyer on 27 February 2020 and shared with ADB and WCS on 28 February 2020 for their feedback.

The Head of Bolikhamxay PAFO, who is also the vice chair of Bolikhamxay Provincial WRPO and NC-NX BOMC, requested WCS during the IAP Mission meeting held between Bolikhamxay Provincial team, NNP1PC, IAP, LTA and WCS on 25 February 2020 to coordinate with DOF-MAF to send an official letter from the central to the Bolikhamxay Province that is needed for further processing at the Provincial Department of Foreign Affair. In addition, the Head also requested WCS to provide Bolikhamxay Provincial WRPO and NC-NX BOMU with an Annual Work Plan with some details on the arrangement (office location/base stations) for each WCS member assigned to assist NNP1PC team and Bolikhamxay Provincial authority.

The IAP Biodiversity Expert, NNP1PC-EMO and WCS discussed during the IAP Mission wrap-up on 28 February 2020 that a detailed working protocol should be further discussed and agreed amongst the parties.

NNP1PC-EMO and WCS team will meet to further discuss:

I. recalculation of NNL due to the reduction of the NC-NX TPZ area from the original BOMP based on GOL's consultations with the local villagers and ground truths survey,
II. working protocol,
III. fund review and approval,
IV. workshop for exchange of experiences related to patrolling and law enforcement,
V. development of strategic document for patrolling and community outreach, and
VI. detailed plan for biology and threat survey and monitoring.

3.5.2.2 IMPLEMENTATION OF BOMP ANNUAL IMPLEMENTATION PLAN (AIP) 2019

Progresses on the implementation of activities by Component are described below:

a. Component 1 - Spatial Planning and Regulation

Bolikhamxay Provincial BOMU procured 60 small signs for TPZ (40x40 cm), 90 small signs for CUZ (40x40 cm), 50 concrete poles and six big signs (2x3 m) as part of standard GOL's method to inform villagers on the agreed NC-NX Total Protected Zone (TPZ). The installation is further postponed to March 2020 due to logistic issue in transporting the signs to NC-NX BOMU office at Viengthong District.

b. Component 2 – Law Enforcement

The monthly patrolling was organized on 06 February 2020 to present and discuss the results of patrolling in January 2020 with the following notes:

- The patrol teams were encouraged to improve the identification and recording of the NNL target species.
- The warning signs in Vietnamese language should be considered to be installed along the identified tracks on the Vietnam side.
- At least one team is scheduled to conduct patrolling in the Xaychamphone District to intercept and address the threats to biodiversity such as hunting, illegal fishing and NTFP collection.

In January 2020, the first team carried out patrolling at TPZ High Priority Area around Nam Houng, Nam Lak, Nam Kha Gni, Nam Tan, Houy Khone, Houy Ping and Houy Kalang. They spent 16 days covering a distance of 85 km on forest patrolling. The team made a total of eight direct observation and five indirect observations of the following wildlife: macaque, muntjacs, otters, red-shanked douc langur, Indochinese serow, white-cheeked gibbon, and wild pig. The team also encountered a number of threats such as three hunting camps, 375 small wire snares, five fishing camps and three fire places identified for fishing. The villagers from Sopkhone Village who collected NTFP in the area were educated about the TPZ and its regulation.

In January 2020, the second team carried out patrolling at Nam Houng TPZ High Priority Area. They spent 16 days covering a distance of 60 km on forest patrolling. The team made a total

of 22 direct observations and seven indirect observations of the following wildlife: black giant squirrels, brown hornbills, crap eating mongooses, East Asian Porcupines, great hornbills, Phayre's Leaf Monkeys, red-shanked douc langur, wild pigs, macaque, civet, Indochinese serow, muntjac, otter, and white-cheeked gibbon. The team also encountered a number of threats such as one hunting camp, one fire place identified for fishing as well as five old camps and signs of tree cutting.

In January 2020, the third team carried out patrolling at the TPZ Highest Priority Area around Nam Chang, Nam Sone, Houy Xaynoi, Houy Xaignai and Houy Poung. They spent 16 days covering a distance of 70 km on forest patrolling. The team made a total of 21 direct observations and five indirect observations of the following wildlife: black giant squirrels, eagle, great hornbills, hog badger, hoopoe, macaques, muntjac, Phayre's Leaf Monkeys, Red-shanked Douc Langurs, rock pythons, white-cheeked gibbons, civet, Indochinese serow, muntjac, sambar and wild pigs. The team also encountered hunting camps that were used by the locals. The team also encountered a number of threats such as three hunting camps and 300 small wire snares that were found at Nam Sone identified to be Vietnamese poachers.

In January 2020, the fourth team carried out patrolling at the TPZ Highest Priority Area around Nam Chouan, Nam Xi and the tributaries at the north-west of Nam Chouan. They spent 16 days covering a distance of 100 km on forest patrolling. The team made a total of 16 direct observations and five indirect observations of the following wildlife: black giant squirrels, brown hornbills, macaques, mongoose, muntjacs, Phayre's Leaf Monkey, civet, muntjac, Indochinese serow, Macaque and wild pig.

FIGURE 3-5: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN JANUARY 2020

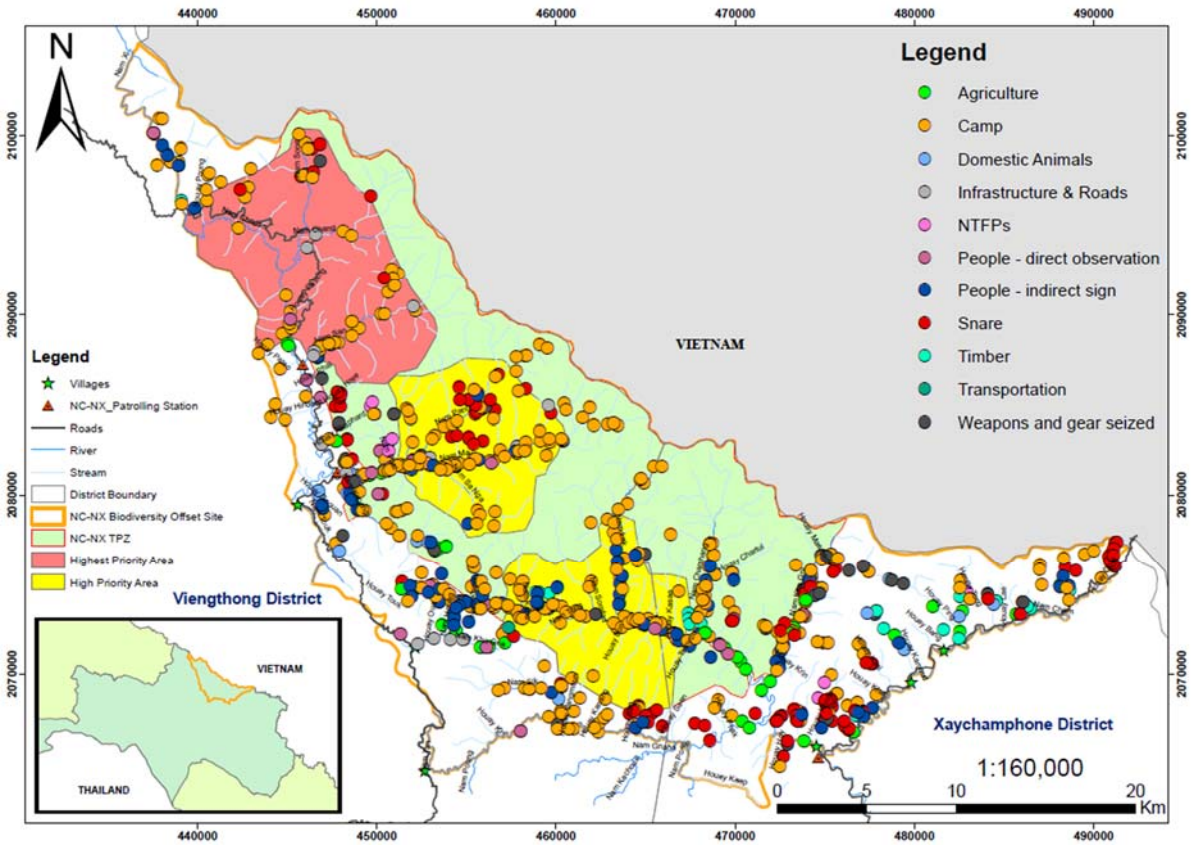


FIGURE 3-6: MAP OF WILDLIFE SIGNS RECORDED BY TWO PATROLLING TEAMS IN JANUARY 2020

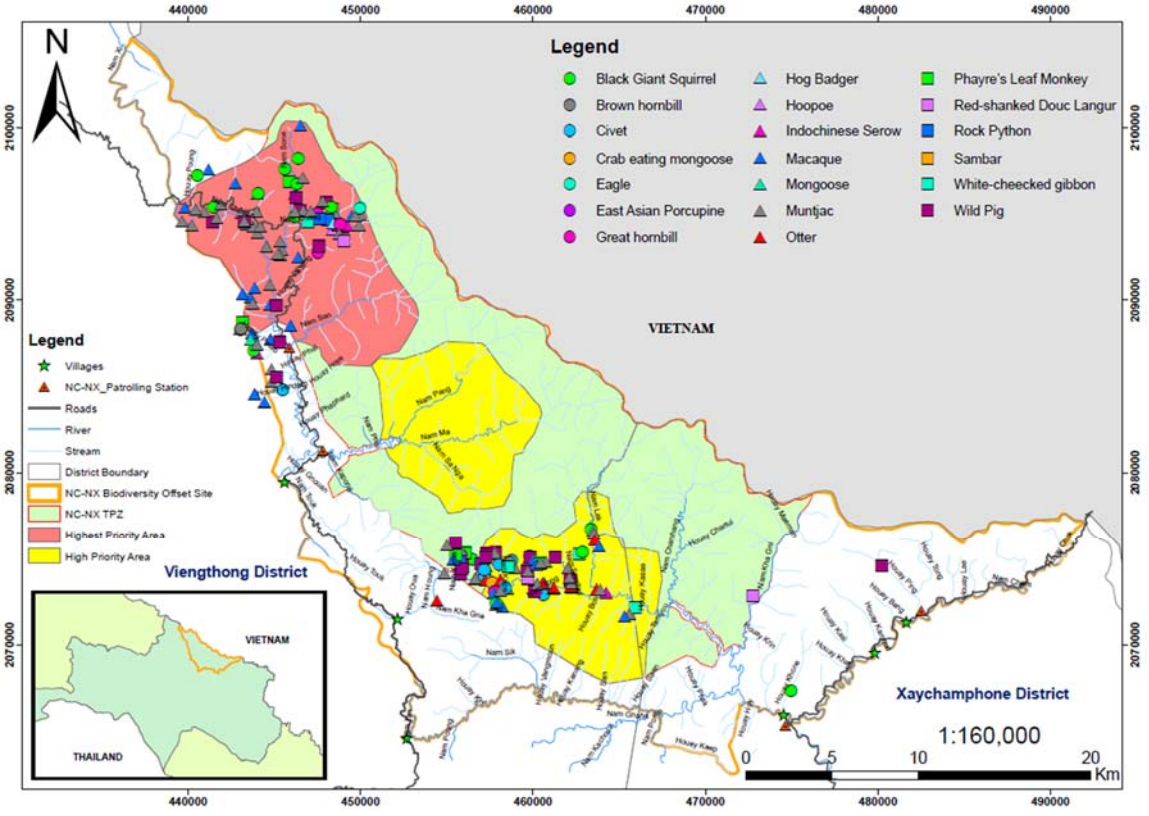
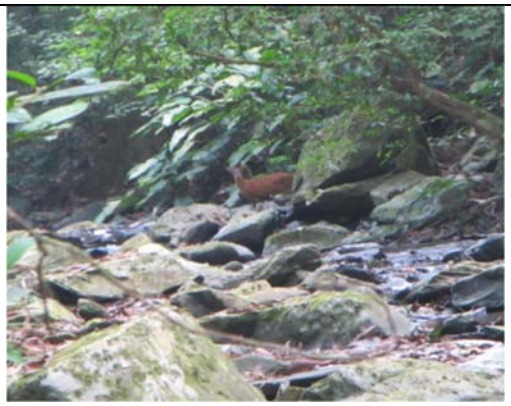


Figure 3-7: Hunting camp destroyed by patrolling team	***Figure 3-8: Small wire snares at Nam Kha Gni area***
	
Figure 3-9: Mongoose	***Figure 3-10: Muntjac***
	

c. Component 4 – Conservation linked livelihood development

NNP1PC-EMO together with a Consultant is preparing a Community Development Plan (CDP) for the six NC-NX villages. The Consultant further improved the Inception Report and re-submitted the report on 13 February 2020. NNP1PC-EMO has provided further comments on 18 February 2020 and the Consultant re-submitted the improved report on 21 February 2020. However, the third re-submission is still unsatisfactory and so NNP1PC-EMO requested a technical discussion with the Consultant to conclude the report and the overall future works. Due to the Consultant unavailability, the meeting was re-scheduled to 3rd March 2020.

3.6 FLOATING DEBRIS REMOVAL

NNP1PC-EMO conducted a regular monitoring and removal of floating materials/logs from the temporary log-boom as needed. Permanent log booms are being installed at the main dam and the re-regulation dam.

4. FISHERY MONITORING

Two species groups and three species dominated the fish catch by weight in January 2020 as listed in ***Table 4-1.*** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species1, except Tor sinensis which is classified as Vulnerable (VU).

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN JANUARY 2020

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	260.9	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	226	LC
Channa striata	ปาถ่ำ	88	LC
Tor sinensis	ปาแดง	74.7	VU
Oreochromis niloticus	ปานิน	74.6	LC

[1] The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in January 2020 is presented in ***Table 4-2.*** The list includes four species that are classified as Vulnerable (VU) species and three Near Threatened (NT) species.

TABLE 4-2: THREATENED SPECIES OF JANUARY 2020 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus cirrhosus	ปามอมจัม/ปาแกง	8	VU
Cirrhinus molitorella	ปาแกง	5.3	NT
Cyprinus carpio	ปาไน	2	VU
Neolissochilus stracheyi	ปาสอง	2.1	NT
Onychostoma gerlachi	ปาถิง	9.3	NT
Scaphognathops bandanensis	ปาอวนไฟ/ปาป่วม	11.5	VU
Tor sinensis	ปาแดง	74.7	VU

The total recorded monthly fish catch for the downstream and upstream fishing households and the Mekong control group involved in the monitoring programme from July 2015 to January 2020 is presented in *Error! Not a valid bookmark self-reference.*. Note that the upstream fish catch excludes the fish catch from the fishing households in Zone 2LR because these households were resettled during Q4-2017.

FIGURE 4-1: TOTAL RECORDED MONTHLY FISH CATCH JULY 2015 – JANUARY 2020

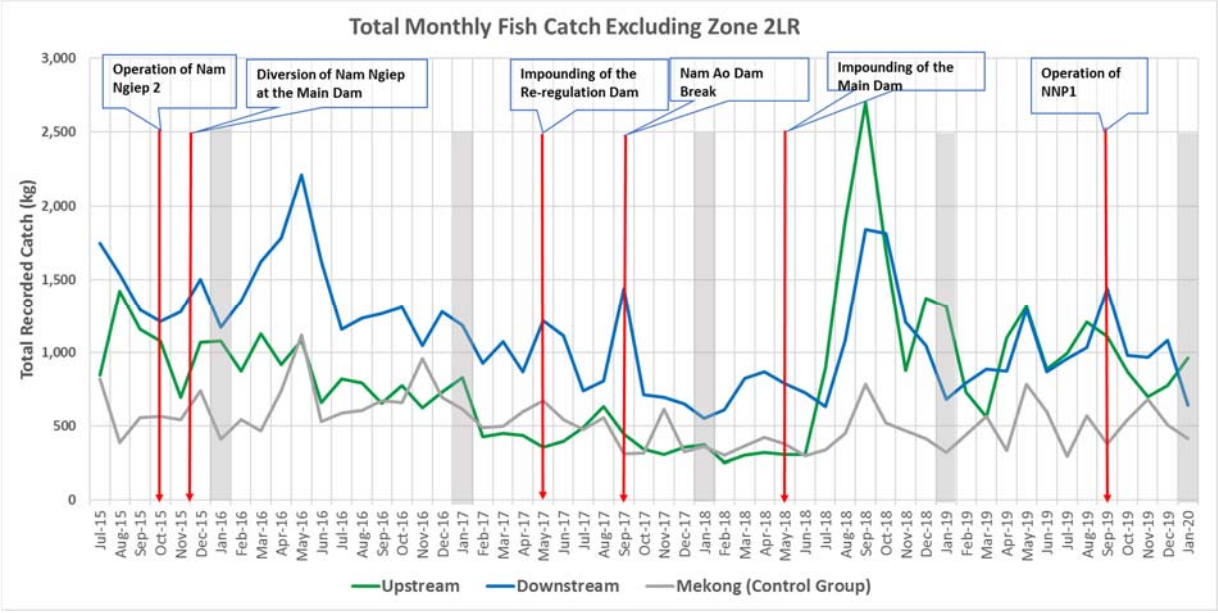
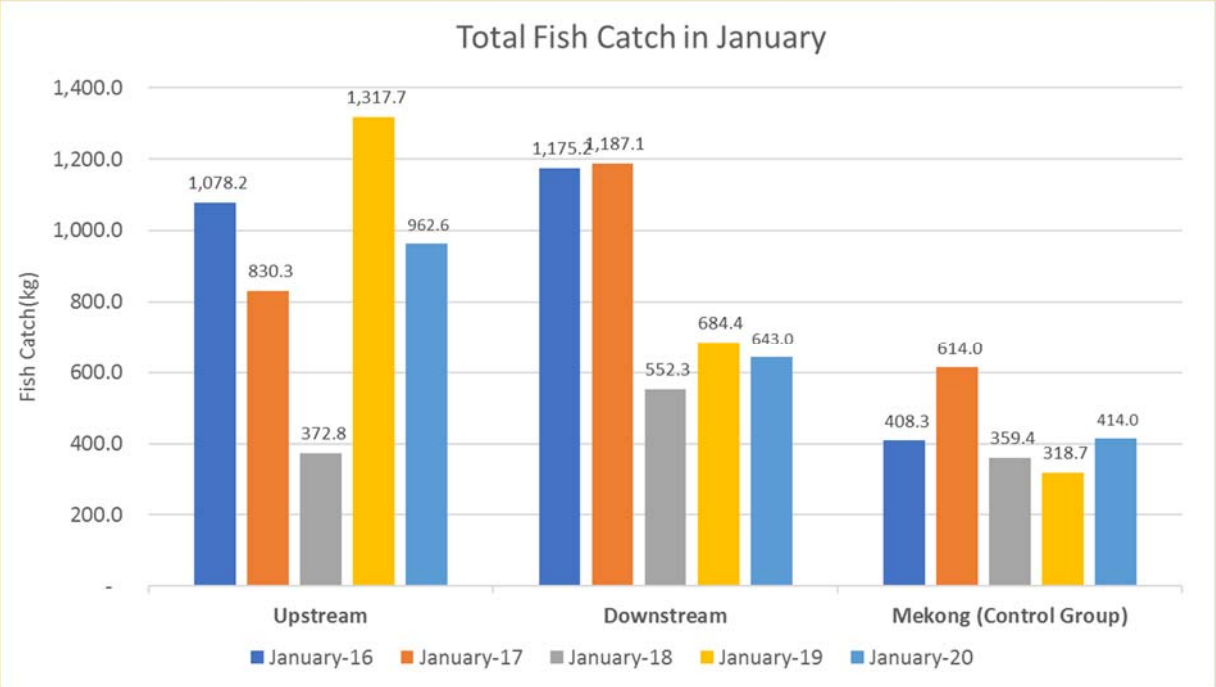


Table 4-3 and **Figure 4-2** show the total recorded fish catch for January 2016, January 2017, January 2018, January 2019 and January 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

Table 4-3: ***TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN JANUARY 2016, JANUARY 2017, JANUARY 2018, JANUARY 2019 AND JANUARY 2020***

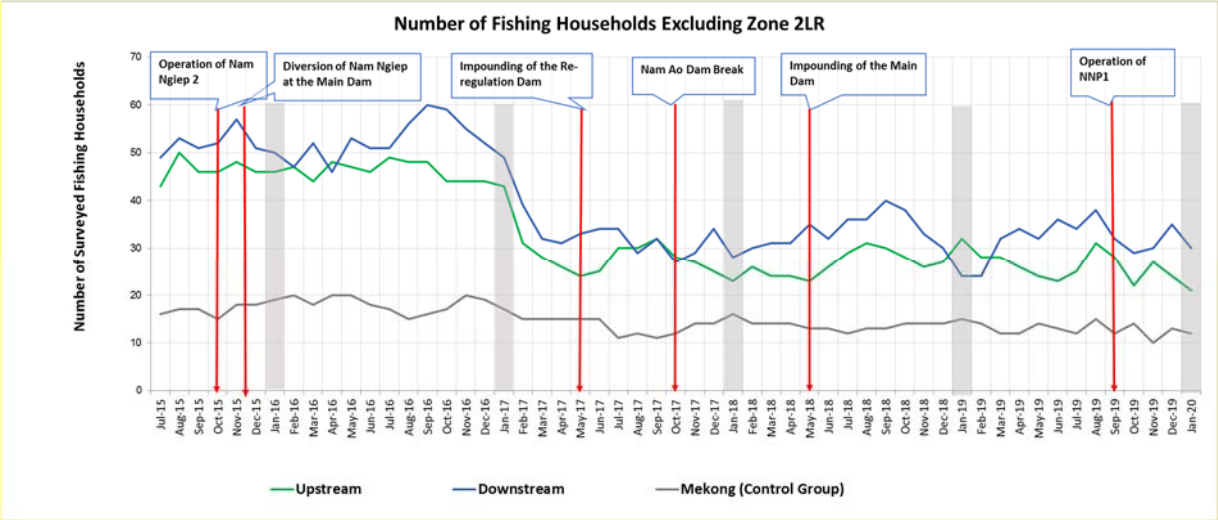
Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)	January 2020 (kg)
Upstream	1,078.2	830.3	372.8	1,317.7	962.6
Downstream	1,175.2	1,187.1	552.3	684.4	643.0
Mekong Control Group	408.3	614.0	359.4	318.7	414.0

FIGURE 4-2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN JANUARY 2016, JANUARY 2017, JANUARY 2018, JANUARY 2019 AND JANUARY 2020



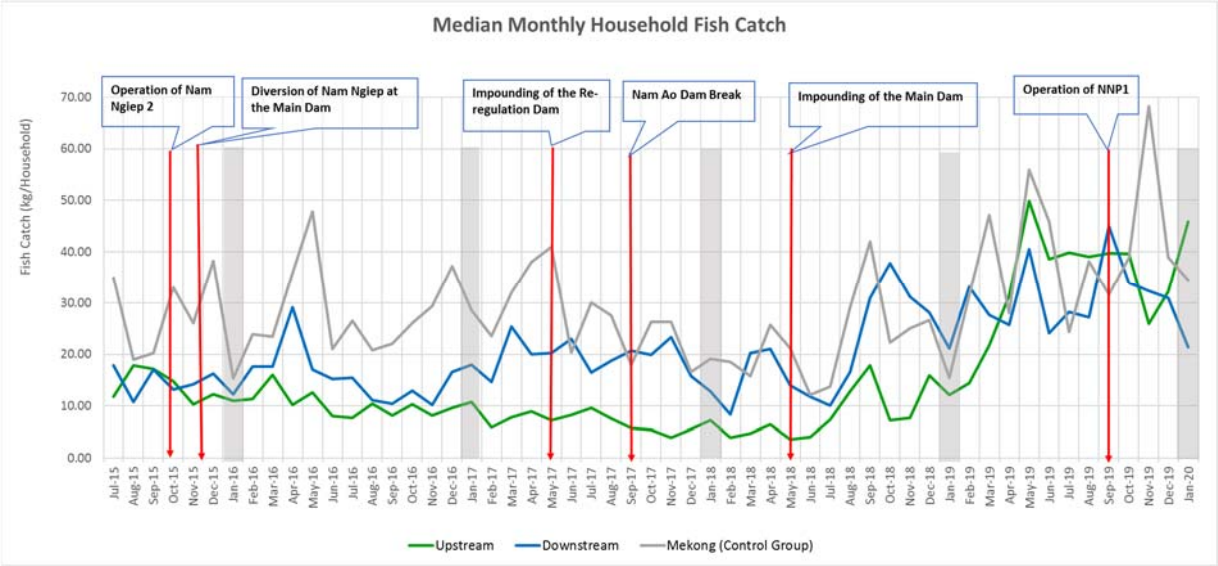
The numbers of fishing households involved in the fish catch monitoring programme are displayed in below

FIGURE 4-3: NUMBER OF FISHING HOUSEHOLDS INVOLVED IN THE FISH CATCH MONITORING PROGRAMME



The median monthly household fish catch from July 2015 to January 2020 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in ***Figure below***.

FIGURE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH WITHOUT ZONE 2LR



The median household fish catch for January 2016, January 2017, January 2018 January 2019 and January 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group are displayed in **Table below;**

TABLE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH IN THE UPSTREAM AND DOWNSTREAM COMMUNITIES EXCLUDING ZONE 2LR

Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)	January 2020 (kg)
Upstream	11.0	10.8	7.3	12.2	45.8
Downstream	12.3	18.0	12.8	21.2	21.4
Mekong Control Group	15.3	28.6	19.1	15.5	34.5

The median daily fish catch per household are displayed in *Error! Reference source not found.*, and the median fish catch per household per fishing day in January 2016, January 2017, January 2018, January 2019 and January 2020 are shown in Table below;

FIGURE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD

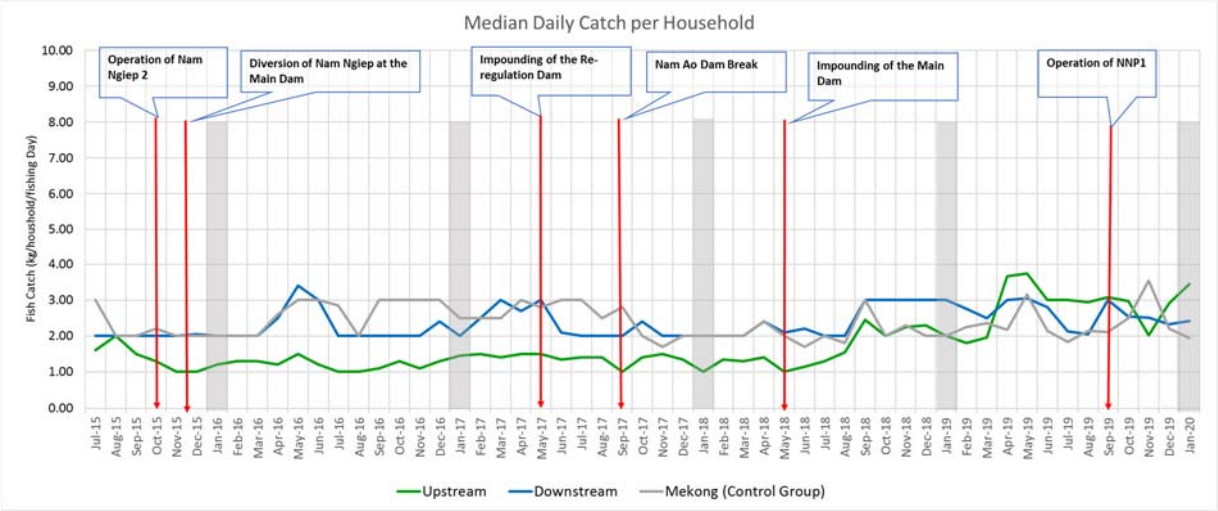


TABLE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD IN JANUARY 2020

Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)	January 2020 (kg)
Upstream	1.20	1.45	1.00	2.00	3.45
Downstream	2.00	2.00	2.00	3.00	2.42
Mekong (Control Group)	2.00	2.50	2.00	2.00	1.95

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

TABLE A- 1: *RESULTS OF MAIN RESERVOIR, RE-REGULATION RESERVOIR AND SURFACE WATER (NAM NGIEP RIVER) QUALITY MONITORING*

		River Name	Nam Ngiep										
		Zone	Location Refer to Construction Sites										
			Upstream/Main Reservoir					Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
4-Feb-20	pH	5.0 - 9.0		7.73	7.6	7.25	7.47							
5-Feb-20	pH	5.0 - 9.0						7.41	7.28	7.27	7.38	7.55	7.82	7.93
11-Feb-20	pH	5.0 - 9.0	7.8	7.87	7.8	7.64								
12-Feb-20	pH	5.0 - 9.0					7.35	7.57						
13-Feb-20	pH	5.0 - 9.0							7.32	7.33	7.32	7.62	7.9	8.04
19-Feb-20	pH	5.0 - 9.0		8.09	8.2	7.82	7.7							
20-Feb-20	pH	5.0 - 9.0						7.69	7.5	7.62	7.69	7.98	8.09	8.24
24-Feb-20	pH	5.0 - 9.0	7.3											
25-Feb-20	pH	5.0 - 9.0		6.81	6.5	6.39	6.71							
26-Feb-20	pH	5.0 - 9.0						6.59	6.7	6.68	6.8	6.91	7.18	7.34
4-Feb-20	Sat. DO (%)			118	33	74.3	56.3							
5-Feb-20	Sat. DO (%)							40.3	42.3	15.7	49.2	43.8	67.2	74.4
11-Feb-20	Sat. DO (%)		110	124	45	69								
12-Feb-20	Sat. DO (%)						67.5	68.1						
13-Feb-20	Sat. DO (%)								39.1	34.4	52.9	49.7	61.2	64.2
19-Feb-20	Sat. DO (%)			95.5	60	80.7	77.2							
20-Feb-20	Sat. DO (%)							51.5	39.4	37.9	45.7	46.6	66.6	68.8
24-Feb-20	Sat. DO (%)		110											
25-Feb-20	Sat. DO (%)			106	70	77.5	80.5							
26-Feb-20	Sat. DO (%)							81.4	56.5	45	48.9	49.1	62.9	68
4-Feb-20	DO (mg/L)	>6.0		9.61	2.7	6.18	4.72							
5-Feb-20	DO (mg/L)	>6.0						3.38	3.58	1.34	4.17	3.67	5.58	6.13
11-Feb-20	DO (mg/L)	>6.0	8.5	9.85	3.6	5.73								
12-Feb-20	DO (mg/L)	>6.0					5.63	5.68						
13-Feb-20	DO (mg/L)	>6.0							3.33	2.91	4.43	4.13	5.06	5.24
19-Feb-20	DO (mg/L)	>6.0		7.72	4.9	6.69	6.44							
20-Feb-20	DO (mg/L)	>6.0						4.34	3.35	3.22	3.8	3.88	5.49	5.64
24-Feb-20	DO (mg/L)	>6.0	8.7											
25-Feb-20	DO (mg/L)	>6.0		8.5	5.8	6.44	6.73							
26-Feb-20	DO (mg/L)	>6.0						6.86	4.77	3.84	4.08	4.09	5.22	5.63
4-Feb-20	Conductivity (µs/cm)			95	91	81	78							
5-Feb-20	Conductivity (µs/cm)							78	91	88	86	87	85	84
11-Feb-20	Conductivity (µs/cm)		70	99	90	82								
12-Feb-20	Conductivity (µs/cm)						78	78						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
13-Feb-20	Conductivity (µs/cm)								93	89	88	88	86	85
19-Feb-20	Conductivity (µs/cm)			104	90	82	78							
20-Feb-20	Conductivity (µs/cm)							78	91	89	90	88	88	86
24-Feb-20	Conductivity (µs/cm)		123											
25-Feb-20	Conductivity (µs/cm)			112	91	83	78							
26-Feb-20	Conductivity (µs/cm)							79	94	89	89	88	87	86
4-Feb-20	Temperature (°C)			25.5	25	24.66	24.32							
5-Feb-20	Temperature (°C)							24.04	23.76	23.65	23.96	24.13	24.72	24.47
11-Feb-20	Temperature (°C)		26	27.1	25	24.71								
12-Feb-20	Temperature (°C)						24.59	24.52						
13-Feb-20	Temperature (°C)								23.74	23.78	24.24	24.19	25.04	25.64
19-Feb-20	Temperature (°C)			25.8	25	24.85	24.36							
20-Feb-20	Temperature (°C)							24.06	23.61	24.01	24.47	24.66	25.14	25.27
24-Feb-20	Temperature (°C)		25											
25-Feb-20	Temperature (°C)			26.8	26	24.83	24.41							
26-Feb-20	Temperature (°C)							24.17	23.77	23.78	24.46	24.27	24.76	25.23
4-Feb-20	Turbidity (NTU)			5.51	3.6	2.35	2.57							
5-Feb-20	Turbidity (NTU)							2.62	3.31	6.47	6.99	7.57	6.62	7.68
11-Feb-20	Turbidity (NTU)		2	10.4	2.5	2.51								
12-Feb-20	Turbidity (NTU)						2.78	1.95						
13-Feb-20	Turbidity (NTU)								2.67	4.74	5.2	5.44	7.3	4.6
19-Feb-20	Turbidity (NTU)			8.84	2.7	2.68	2.26							
20-Feb-20	Turbidity (NTU)							2.5	4.83	4.7	5.07	7.18	6.12	8.66
24-Feb-20	Turbidity (NTU)		3											
25-Feb-20	Turbidity (NTU)			10.2	2.7	2.45	2.28							
26-Feb-20	Turbidity (NTU)							2.33	2.49	5.58	4.86	5.57	5.1	7.58
11-Feb-20	TSS (mg/L)		<5	15		<5								
11-Feb-20	TSS (mg/L)-bottom					<5								
12-Feb-20	TSS (mg/L)						<5	<5						
12-Feb-20	TSS (mg/L)-bottom						158.91	<5						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
13-Feb-20	TSS (mg/L)								<5	<5	<5	<5	11.41	11.3
11-Feb-20	BOD_5 (mg/L)	<1.5	<1.0	3.1		<1.0								
11-Feb-20	BOD_5 (mg/L)-bottom					<1.0								
12-Feb-20	BOD_5 (mg/L)	<1.5					<1.0	<1.0						
12-Feb-20	BOD_5 (mg/L)-bottom						5.85	2.13						
13-Feb-20	BOD_5 (mg/L)	<1.5							<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
11-Feb-20	COD (mg/L)	<5.0	8.4											
13-Feb-20	COD (mg/L)	<5.0							6.8	7.6	<5.0	<5.0	5	6.6
11-Feb-20	NH_3-N (mg/L)	<0.2	<0.2	<0.2		<0.2								
11-Feb-20	NH_3-N (mg/L)-bottom	<0.2				<0.2								
12-Feb-20	NH_3-N (mg/L)	<0.2					<0.2	<0.2						
12-Feb-20	NH_3-N (mg/L)-bottom	<0.2					<0.2	<0.2						
11-Feb-20	NO_3-N (mg/L)-bottom	<5.0				0.03								
11-Feb-20	NO_3-N (mg/L)	<5.0	<0.02	0.03		0.03								
12-Feb-20	NO_3-N (mg/L)-bottom	<5.0					<0.02	<0.02						
12-Feb-20	NO_3-N (mg/L)	<5.0		0.03			0.03	0.05						
11-Feb-20	Faecal coliform (MPN/100 ml)	<1,000	170	26		0								
11-Feb-20	Total Coliform (MPN/100 ml)-bottom	<1,000				17								
12-Feb-20	Faecal coliform (MPN/100 ml)	<1,000					14	0						
12-Feb-20	Total Coliform (MPN/100 ml)-bottom	<1,000					170	140						
13-Feb-20	Faecal coliform (MPN/100 ml)	<1,000							2	2	5	11	46	46
11-Feb-20	Total Coliform (MPN/100 ml)	<5,000	920	####		280								
11-Feb-20	Faecal coliform (MPN/100 ml)-bottom	<5,000				0								
12-Feb-20	Total Coliform (MPN/100 ml)	<5,000					1,600	280						
12-Feb-20	Faecal coliform (MPN/100 ml)-bottom	<5,000					2	0						
13-Feb-20	Total Coliform (MPN/100 ml)	<5,000							27	47	430	280	1,600	280

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
11-Feb-20	TKN		<1.5	<1.5		<1.5								
11-Feb-20	TKN-bottom					<1.5								
12-Feb-20	TKN						<1.5	<1.5						
12-Feb-20	TKN-bottom						<1.5	<1.5						
11-Feb-20	TOC (mg/L)		1											
13-Feb-20	TOC (mg/L)								1.54					
11-Feb-20	Phytoplankton Biomass (g dry wt/m³)			13.2		1.8								
11-Feb-20	Phytoplankton Biomass (g dry wt/m³)-bottom					3.2								
12-Feb-20	Phytoplankton Biomass (g dry wt/m³)						0.4	0.6						
12-Feb-20	Phytoplankton Biomass (g dry wt/m³)-bottom						52	0.8						
11-Feb-20	Total Phosphorus (mg/L)		0	<0.01		<0.01								
11-Feb-20	Total Phosphorus (mg/L)-bottom					<0.01								
12-Feb-20	Total Phosphorus (mg/L)						<0.01	<0.01						
12-Feb-20	Total Phosphorus (mg/L)-bottom						0.02	0.02						
11-Feb-20	Total Dissolved Phosphorus (mg/L)		<0.01	<0.01		<0.01								
11-Feb-20	Total Dissolved Phosphorus (mg/L)-bottom					<0.01								
12-Feb-20	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01						
12-Feb-20	Total Dissolved Phosphorus (mg/L)-bottom						0.01	<0.01						
11-Feb-20	Hydrogen Sulfide (mg/L)	<0.2				<0.02								
11-Feb-20	Hydrogen Sulfide (mg/L)-bottom	<0.2				<0.02								
12-Feb-20	Hydrogen Sulfide (mg/L)	<0.2					<0.02	<0.02						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
12-Feb-20	Hydrogen Sulfide (mg/L)-bottom	<0.2					0.21	0.57						

TABLE A-2: ***RESULTS OF SURFACE WATER QUALITY MONITORING IN NAM CHIAN, NAM PHOUAN, NAM XAO AND NAM HOUAY SOUP***

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
4-Feb-20	pH	5.0 - 9.0		7.54		
5-Feb-20	pH	5.0 - 9.0			7.48	7.71
11-Feb-20	pH	5.0 - 9.0	8.35	7.95		
12-Feb-20	pH	5.0 - 9.0				
13-Feb-20	pH	5.0 - 9.0			7.69	7.32
19-Feb-20	pH	5.0 - 9.0		8.04		
20-Feb-20	pH	5.0 - 9.0			7.86	7.9
24-Feb-20	pH	5.0 - 9.0	7.48			
25-Feb-20	pH	5.0 - 9.0		6.65		
26-Feb-20	pH	5.0 - 9.0			6.98	7.2
4-Feb-20	Sat. DO (%)			91.4		
5-Feb-20	Sat. DO (%)				72.9	64.9
11-Feb-20	Sat. DO (%)		108.2	88.2		
12-Feb-20	Sat. DO (%)					
13-Feb-20	Sat. DO (%)				78	76.2
19-Feb-20	Sat. DO (%)			86.2		
20-Feb-20	Sat. DO (%)				87.8	78
24-Feb-20	Sat. DO (%)		100.9			
25-Feb-20	Sat. DO (%)			88.5		
26-Feb-20	Sat. DO (%)				73.9	76.2
4-Feb-20	DO (mg/L)	>6.0		7.99		
5-Feb-20	DO (mg/L)	>6.0			6.21	6.05
11-Feb-20	DO (mg/L)	>6.0	8.91	7.81		
12-Feb-20	DO (mg/L)	>6.0				
13-Feb-20	DO (mg/L)	>6.0			6.31	6.09
19-Feb-20	DO (mg/L)	>6.0		7.35		
20-Feb-20	DO (mg/L)	>6.0			7.03	6.67
24-Feb-20	DO (mg/L)	>6.0	8.47			
25-Feb-20	DO (mg/L)	>6.0		7.84		
26-Feb-20	DO (mg/L)	>6.0			6.06	6.23
4-Feb-20	Conductivity (µs/cm)			81		
5-Feb-20	Conductivity (µs/cm)				99	66
11-Feb-20	Conductivity (µs/cm)		35.8	80		
12-Feb-20	Conductivity (µs/cm)					
13-Feb-20	Conductivity (µs/cm)				131	58
19-Feb-20	Conductivity (µs/cm)			81		
20-Feb-20	Conductivity (µs/cm)				168	93
24-Feb-20	Conductivity (µs/cm)		27.2			
25-Feb-20	Conductivity (µs/cm)			83		
26-Feb-20	Conductivity (µs/cm)				122	68

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
4-Feb-20	Temperature (°C)			21.39		
5-Feb-20	Temperature (°C)				25.18	25.02
11-Feb-20	Temperature (°C)		23.1	21.38		
12-Feb-20	Temperature (°C)					
13-Feb-20	Temperature (°C)				26.1	25.33
19-Feb-20	Temperature (°C)			22.29		
20-Feb-20	Temperature (°C)				26.64	23.04
24-Feb-20	Temperature (°C)		21.8			
25-Feb-20	Temperature (°C)			21.4		
26-Feb-20	Temperature (°C)				25.58	25.53
4-Feb-20	Turbidity (NTU)			4.56		
5-Feb-20	Turbidity (NTU)				7.02	6.1
11-Feb-20	Turbidity (NTU)		1.28	5.04		
12-Feb-20	Turbidity (NTU)					
13-Feb-20	Turbidity (NTU)				4.71	4.49
19-Feb-20	Turbidity (NTU)			4.99		
20-Feb-20	Turbidity (NTU)				5.08	5.42
24-Feb-20	Turbidity (NTU)		2.72			
25-Feb-20	Turbidity (NTU)			5.95		
26-Feb-20	Turbidity (NTU)				5.25	4.23
11-Feb-20	TSS (mg/L)		<5	11.62		
13-Feb-20	TSS (mg/L)				5.6	<5
11-Feb-20	BOD_5 (mg/L)	<1.5	<1.0	<1.0		
13-Feb-20	BOD_5 (mg/L)	<1.5			1.87	2.12
11-Feb-20	COD (mg/L)	<5.0	8.4			
13-Feb-20	COD (mg/L)	<5.0			13.2	12.2
11-Feb-20	NH_3-N (mg/L)	<0.2	<0.2	<0.2		
11-Feb-20	NO_3-N (mg/L)	<5.0	0.07	0.07		
11-Feb-20	Faecal coliform (MPN/100 mL)	<1,000	33	14		
13-Feb-20	Faecal coliform (MPN/100 mL)	<1,000			5	17
11-Feb-20	Total Coliform (MPN/100 mL)	<5,000	220	350		
13-Feb-20	Total Coliform (MPN/100 mL)	<5,000			1,600	170
11-Feb-20	TKN		<1.5	<1.5		
11-Feb-20	TOC (mg/L)		0.79	1.06		
11-Feb-20	Total Phosphorus (mg/L)		<0.01			
12-Feb-20	Total Phosphorus (mg/L)			<0.01		
11-Feb-20	Total Dissolved Phosphorus (mg/L)		<0.01			
12-Feb-20	Total Dissolved Phosphorus (mg/L)			<0.01		

ANNEX B: RESULTS OF EFFLUENT ANALYSES

TABLE B-1: *RESULTS OF CAMP EFFLUENTS IN FEBRUARY 2020*

	Site Name	Owner's Site Office and Village		ESD Camp No.2 (HM Main Camp)		ESD Camp		Main Powerhouse	
	Station Code	EF01		EF13		EF14		EF19	
	Date	03-Feb-20	17-Feb-20	03-Feb-20	17-Feb-20	03-Feb-20	17-Feb-20	03-Feb-20	17-Feb-20
Parameters (Unit)	**Guideline**								
pH	6.0 - 9.0	6.90	6.9	6.78	7.19	7.02	6.36	7.32	7.6
Sat. DO (%)		46.4	47.6	20.9	55.7	16.1	78.5	40.9	59.7
DO (mg/L)		3.61	3.71	1.63	4.41	1.23	6.11	3	4.5
Conductivity (µs/cm)		338	425	508	435	430	252	1016	1,050
TDS (mg/L)		169	212.5	254	217.5	215	126	508	525
Temperature (°C)		26.9	26.9	26.3	26	27.4	27	29.9	28.9
Turbidity (NTU)		0.95	0.73	8.75	9.1	12.09	9.32	14.55	11.41
TSS (mg/L)	<50	<5	<5	11.0	9.8	10.36	7.31	57.7	56.6
BOD5 (mg/L)	<30	<6	<6	<6	<6	<6	<6	26.92	<6
COD (mg/L)	<125	<25	<25	34	53.4	60.8	<25	156	98.4
NH3-N (mg/L)	<10.0	4	<1.5	20.5	22	16.4	<1.5	66	63.7
Total Nitrogen (mg/L)	<10.0	5.48	2.14	25.6	31.8	21.3	4.44	72.8	73.6
Total Phosphorus (mg/L)	<2	1.21	1.35	1.46	1.47	1.25	0.61	2.66	2.55
Oil & Grease (mg/L)	<10.0	<1		<1		<1		<1	
Total coliform (MPN/100mL)	<400	23	11	0	0	0	0	540	350
Faecal Coliform (MPN/100mL)	<400	5	0	0	0	0	0	350	350
Effluent Discharge Volume (L/mn)			4	4	4	3.3	3		
Chlorination Dosing Rate (ml/mn)		n/a	n/a	70	51	100	45	435	450
Residual Chlorine (mg/L)	<1.0	n/a	n/a	1.1	0.7	0.6	0.45	0	0.79

TABLE B-2: *RESULTS OF THE CONSTRUCTION AREA DISCHARGE IN FEBRUARY 2020*

	Site Name	Upstream Spoil Disposal Area No.2			
	Station Code	DS04 - US			
	Date	07-Feb-20	14-Feb-20	21-Feb-20	27-Feb-20
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.15	6.07	6.25	6.23
Sat. DO (%)		56.6	38.3	40.7	45.4
DO (mg/L)		4.65	3.07	3.5	4.01
Conductivity (µs/cm)		12	14.14	39	16
TDS (mg/L)		6	7.7	19.5	8
Temperature (°C)		24.98	25	23.1	22.75
Turbidity (NTU)		4.02	41.56	26.46	37.87
TSS (mg/L)	<50			37.54	

	Site Name	Spoil Disposal Area No.2			
	Station Code	DS04			
	Date	07-Feb-20	14-Feb-20	21-Feb-20	27-Feb-20
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.41	6.35	5.85	5.83
Sat. DO (%)		45.8	50	67.8	62.5
DO (mg/L)		3.72	3.94	5.52	5.17
Conductivity (µs/cm)		58	55	89	99
TDS (mg/L)		29	27.5	44.5	49.5
Temperature (°C)		25	25.5	25.79	25.4
Turbidity (NTU)		3.12	3.13	3.63	4.28
TSS (mg/L)	<50			1.19	